4.3 Logarithmic Differentiation

$$\frac{d}{dx}(x^2+1)^{\sin x}$$

$$y=(x^2+1)^{\sin x}$$

$$\ln y=\sin x\ln(x^2+1)$$

$$\ln y=(\sin x)(\ln(x^2+1))$$

$$\frac{1}{y}\left(\frac{dy}{dx}\right)=(\cos x)(\ln(x^2+1))+(\sin x)\left(\frac{1}{x^2+1}(2x)\right)$$

$$\frac{dy}{dx}=y\left[(\cos x)\ln(x^2+1)+\frac{2x\sin x}{x^2+1}\right]$$

5.1) if f is continuous

$f'(x) > 0$ means f^n $f(x)$ is increasing

$f'(x) < 0$ means $f(x)$ decreasing

3.5 (17)

$$\frac{d}{dx} 4\cos^5 x$$

$$= \frac{d}{dx}\left(4(\cos x)^5\right)$$

$$= 4\left[5(\cos x)^4(-\sin x)\right]$$

exp(x)= e^x

4.3 logarithmic differentiation

$$y = (x^2+1)^{\sin x}$$

x^x

$$\ln y = \sin x \ln(x^2+1)$$

$$\frac{1}{y}\frac{dy}{dx} = (\cos x)\left(\ln(x^2+1)\right) + (\sin x)\left(\frac{2x}{x^2+1}\right)$$

$$\frac{dy}{dx} = y\left[(\cos x)\left(\ln(x^2+1)\right) + \frac{2x\sin x}{x^2+1}\right]$$

5.1) f continuous

f increasing $\quad f'(x) > 0$

f decreasing $\quad f'(x) < 0$

$f(x) = \sin x$ .... $f'(x) = \cos x$ $f'(\frac{\pi}{3}) = \cos(\frac{\pi}{3})$

$$f'\left(\frac{\pi}{3}\right) = \lim_{x \to \frac{\pi}{3}} \frac{\sin x - \sin\frac{\pi}{3}}{x - \frac{\pi}{3}}$$

$$f'(x_0) = \lim_{x_1 \to x_0} \frac{f(x_1) - f(x_0)}{x_1 - x_0}$$

write the limit def^n of derivative of $\sin x$ at $x = \frac{\pi}{3}$

$$\lim_{h \to 0} \frac{\left[2(x+h)^2 + 3(x+h)\right] - 2x^2 - 3x}{h}$$

$$f(x) = 2x^2 + 3x$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Power Rule

$$\frac{d}{dx}\left(x^{n}\right) = n\,x^{n-1}$$

Exponential

$$\frac{d}{dx}\left(n^{x}\right) = \left(n^{x}\right)\left(\ln n\right)$$